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**United States Patent** [19][11] **Patent Number:** **5,572,424****Kellogg et al.**[45] **Date of Patent:** **Nov. 5, 1996**[54] **DIAGNOSTIC SYSTEM FOR AN ENGINE  
EMPLOYING COLLECTION OF EXHAUST  
GASES**[75] **Inventors:** **Robert L. Kellogg; Kenneth S.  
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Roseville, Minn.**[21] **Appl. No.:** **247,542**[22] **Filed:** **May 23, 1994**[51] **Int. Cl.<sup>6</sup>** ..... **F02B 27/04**[52] **U.S. CL** ..... **364/424.03**[58] **Field of Search** ..... **364/424.03, 496;  
73/23.31, 863.01, 117, 117.3; 340/439;  
356/51**[56] **References Cited****U.S. PATENT DOCUMENTS**

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Welter & Schmidt[57] **ABSTRACT**

A computer implemented method for providing a diagnosis for automotive engine malfunctions using collected vehicle emissions data. The concentration levels of gases within exhaust emitted from a vehicle engine being determined and compared to a plurality of predetermined concentration level data sets stored in a database to find a matching data set. Each predetermined concentration level data set having corresponding engine diagnosis data for identifying engine malfunction. The engine diagnosis and concentration level data being printed on a testing diagnosis form to be filled out by mechanics upon repair of the malfunctioning engine. Upon return of a previously tested vehicle that has been repaired, the same test is performed on the vehicle and the newly collected concentration level data is compared with the prior failing concentration level data to determine the accuracy of the repair performed. The database within the computer is updated with a new diagnosis and concentration level data set when the repair performed is different than that recommended by the diagnosis or when the new concentration level data set generated is not found within the database. This provides the closed loop learning system in which new failure concentration level data sets and an associated diagnosis are stored for addition to the database.

**15 Claims, 41 Drawing Sheets**